

REMARKS

The Office Action mailed September 21, 2004, has been received and reviewed. Claims 19, 21 through 23, and 25 through 34 are currently pending in the application. Claims 19, 21 through 23, 25, 27, and 29 through 34 stand rejected. Claims 26 and 28 have been objected to as being dependent upon rejected base claims, but the indication of allowable subject matter in such claims is noted with appreciation.

Applicant has amended claim 19 and respectfully requests reconsideration of the application in view of the arguments set forth hereinbelow.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,851,845 to Wood et al. in view of U.S. Patent No. 5,281,846 to Kaiser

Claim 19 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Wood et al. (U.S. Patent No. 5,851,845) in view of Kaiser et al. (U.S. Patent No. 5,281,846). Applicant respectfully traverses this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The 35 U.S.C. § 103(a) obviousness rejections of the claims are improper because the references relied upon by the Examiner fail to teach or suggest all of the limitations of the presently claimed invention and because there is a lack of motivation to combine the references in the manner proposed by the Examiner.

Claim 19 of the presently claimed invention is directed to a method of fabricating a multi-die assembly, comprising: providing a substrate including a plurality of conductors;

attaching at least one active face-down base die to the substrate in electrical communication with at least some of the plurality of conductors; *providing a layer of electrically conductive epoxy adhesive to a back side of the at least one base die; placing a back side of at least one active face-up stack die on the layer of electrically conductive epoxy adhesive; curing the layer of electrically conductive epoxy adhesive and securing the back side of at least one stack die to the at least one base die; providing a direct electrical path between the at least one stack die and at least one of the plurality of conductors; and electrically grounding the at least one base die via the layer of electrically conductive epoxy adhesive and the at least one stack die.*

The Examiner cites Wood as disclosing a method of fabrication a mutli-die assembly, comprising: “providing a substrate 26 including a plurality of conductors 28; attaching at least one active face down base die 12B to the substrate in electrical communication with at least some of the plurality of conductors; providing a layer of adhesive 22 to a back side of the at least one base die; placing a back side of at least on active face up stack die 12t on the layer of adhesive 22 (figs. 4 and 5, column 4, lines 59-64); curing the layer of adhesive (column 4, lines 13-19) and securing the back side of at least one stack die to at least one base die (figs. 4-5, column 4, lines 57-64).” (Office Action, pages 2 and 3).

The Examiner notes that Wood fails to disclose the use of an electrically conductive epoxy as an adhesive layer or “providing a direct electrical path between the dice.” (Office Action, page 3).

The Examiner then cites Kaiser as disclosing a method of fabrication a multi-die assembly, comprising: “providing a base die 14; providing a stack die 22; providing an electrically conductive adhesive 20 (fig. 1, column 2, lines 55-56) is [sic] between the base die and the stack die; providing a direct electrical path between the at least one stack die and the base die (column 2, lines 27-32); [and] electrically grounding the at least one base die via the layer of conductive adhesive and the at least one stack die (fig. 1).” (Office Action, page 3).

The Examiner concludes that “it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device structure of Wood et al. to provide an electrical connection between the chips (column 2, lines 28-30), as shown by Kaiser.” (*Id.*). Applicant respectfully disagrees.

Wood discloses a method of fabricating a semiconductor die that includes thinning a wafer (10, 10t) containing a plurality of dice (12, 12t). The thinned wafer is coupled to a substrate wafer (20W) by way of a compliant adhesive layer 22. Individual dice are then singulate from the wafer including corresponding portions of the substrate wafer (20W). The resulting package is stated to provide increased protection from disparate rates of thermal expansion and from radiation during various processes. Wood does not teach or suggest that the substrate wafer (20W) includes individual semiconductor dice or that there is any electrical connection between the substrate wafer (20W) and the dice (12t). Rather, Wood only discloses the substrate wafer to have a structural functionality in providing protection (e.g., radiation protection) to the thinned dice (12t) while being joined thereto in a manner that compensates for different rates of thermal expansion (*i.e.*, by way of the compliant adhesive layer). As such, Applicant submits that Kaiser clearly fails to teach or suggest placing a back side of at least one *active face-up stack die* on the layer of electrically conductive epoxy adhesive. In other words, Wood doesn't disclose that the substrate wafer (20W) includes an active face whatsoever.

Kaiser discloses an electronic device having a lead frame (10), a layer of electrically conductive adhesive (12) disposed thereon, a capacitor (14) mounted to the lead frame by means of the adhesive, and an integrated circuit chip (22) mounted to the capacitor by means of another layer of electrically conductive adhesive (20). The integrated circuit chip (22) is electrically coupled to the lead frame by bond wires (28, 30, 32). The resulting structure is a compact arrangement that accommodates a relatively large capacitor for use in applications where a "batteryless responder of a transponder arrangement" is required such as for implantation of the chips in living animals. (See col. 3, lines 22-31). However, Kaiser fails to teach or suggest a method of fabricating a multi-die assembly that includes attaching at least *one active face-down base die* to the substrate in electrical communication with at least some of the plurality of conductors; providing a layer of electrically conductive epoxy adhesive to a back side of the at least one base die; and *placing a back side of at least one active face-up stack die* on the layer of electrically conductive epoxy adhesive.

In sum, neither Wood nor Kaiser teach or suggest attaching an *active face-down die* on a substrate in electrical communication therewith, and subsequently placing a back side of at least one *active face-up stack die* on a layer of adhesive disposed on the back side of the base die.

Furthermore, Applicant submits that there is a lack of motivation to combine Wood and Kaiser in the manner proposed by the Examiner. As noted hereinabove, Wood fails to teach or suggest that the substrate wafer has any electrical function whatsoever. As such, one of ordinary skill in the art would clearly lack motivation to form the compliant adhesive layer of an electrically conductive material.

Additionally, replacement of the capacitor of Kaiser with a semiconductor die would render Kaiser's electronic device inadequate for its intended purpose since a relatively large capacitor is required for the transponder/responder functionality described by Kaiser.

As such, Applicant submits that claim 19 is clearly not obvious based on Wood and Kaiser and respectfully request reconsideration and allowance thereof.

Obviousness Rejection Based on U.S. Patent No. 5,851,845 to Wood et al. in view of U.S. Patent No. 5,281,846 to Kaiser and further in view of U.S. Patent No. 5,323,060 to Fogal et al.

Claims 21 through 23, 25, 27, 29, 33 and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Wood et al. (U.S. Patent No. 5,851,845) in view of Kaiser et al. (U.S. Patent No. 5,281,846) and further in view of Fogal et al. (U.S. Patent No. 5,323,060). Applicant respectfully traverses this rejection, as hereinafter set forth.

Each of claims 21 through 23, 25, 27, 29, 33 and 34 depend from independent claim 19. The Examiner relies on Wood and Kaiser as applied to claim 19 and then cites Fogal as disclosing a multichip module including a discrete component (75) coupled to the substrate (12) and discrete components (76) and (78) attached by an adhesive layer to an upper-most chip (85). The Examiner further cites Fogal as disclosing bond wires (44a, 44b, and 79-81), extending between the substrate and the chips. (See, Office Action, page 4). The Examiner concludes that "it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Wood et al. and Kaiser to provide additional necessary components." (Office Action, page 4).

As discussed hereinabove, the combination of Wood and Kaiser fails to render claim 19 obvious. Specifically, neither Wood nor Kaiser teach or suggest attaching an *active face-down die* on a substrate in electrical communication therewith, and subsequently placing a back side of at least one *active face-up stack die* on a layer of adhesive disposed on the back side of the base die. Fogal similarly fails to teach or suggest such subject matter.

Furthermore, as previously discussed, there is a lack of motivation to combine Wood and Kaiser in the manner proposed by the Examiner. As noted hereinabove, Wood fails to teach or suggest that the substrate wafer has any electrical function whatsoever. As such, one of ordinary skill in the art would lack motivation to form the compliant adhesive layer of an electrically conductive material.

Additionally, replacement of the capacitor of Kaiser with a semiconductor die would render Kaiser's electronic device inadequate for its intended purpose since a relatively large capacitor is required for the transponder/responder functionality described by Kaiser.

As such, Applicant submits that claims 21 through 23, 25, 27, 29, 33 and 34 are allowable as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

With respect to claims 23, 25, 27 and 29, Applicant submits that there is no motivation to secure at least another stack die to the assembly and electrically connect the at least another stack die and at least one of the plurality of substrate conductors. As previously discussed, Wood does not teach or suggest that the substrate wafer (20W) has any electrical function but, rather, teaches that it is a structural component. As such, Wood is not advocating the preparation of a multi-die assembly and, therefore, there is a lack of motivation to "secure at least another stack die" to the device of Wood. Additionally, Kaiser teaches a very specific arrangement of components due to the need for compactness of the resulting structure based on the specific application thereof. Securing "at least another stack die" to the assembly would go against the teachings of Kaiser in minimizing the resulting package.

Similarly, with respect to claims 25, 27 and 29, Applicant submits that there is a lack of motivation to secure the at least another stack die to the at least one stack die.

Applicant, therefore, requests reconsideration and allowance of claims 21 through 23, 25, 27, 29, 33 and 34.

Obviousness Rejection Based on U.S. Patent No. 5,851,845 to Wood et al. in view of U.S. Patent No. 5,281,846 to Kaiser and further in view of U.S. Patent No. 5,399,898 to Rostoker

Claims 30 through 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Wood et al. (U.S. Patent No. 5,851,845) in view of Kaiser et al. (U.S. Patent No. 5,281,846) and further in view of Rostoker (U.S. Patent No. 5,399,898). Applicant respectfully traverses this rejection, as hereinafter set forth.

Each of claims 30 through 32 depend from independent claim 19. The Examiner relies on Wood and Kaiser as applied to claim 19 and then cites Rostoker as disclosing: “attaching at least two active face down base die 404 and 410 (fig. 4a, column 14, lines 40 et seq.) to the substrate 402 and electrically coupling each of the base die with one of the plurality [of] substrate conductors 406 and 412; ...bridging 416 at least one stack die between the two base die; and further comprising securing at least another stack die over the at least one stack die (fig. 3b).” (Office Action, pages 5 and 6).

The Examiner concludes that “it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Wood et al. and Kaiser to provide a greater power dissipation and a natural convection cooling channel and design flexibility in mounting semiconductor device, as shown by Rostoker.” (*Id.*). Applicant respectfully disagrees.

As discussed hereinabove, the combination of Wood and Kaiser fails to render claim 19 obvious. Specifically, neither Wood nor Kaiser teach or suggest attaching an *active face-down die* on a substrate in electrical communication therewith, and subsequently placing a back side of at least one *active face-up stack die* on a layer of adhesive disposed on the back side of the base die. Fogal similarly fails to teach or suggest such subject matter.

Furthermore, as previously discussed, there is a lack of motivation to combine Wood and Kaiser in the manner proposed by the Examiner. As noted hereinabove, Wood fails to teach or suggest that the substrate wafer has any electrical function whatsoever. As such, one of ordinary

skill in the art would lack motivation to form the compliant adhesive layer of an electrically conductive material.

Additionally, replacement of the capacitor of Kaiser with a semiconductor die would render Kaiser's electronic device inadequate for its intended purpose since a relatively large capacitor is required for the transponder/responder functionality described by Kaiser.

As such, Applicant submits that claims 30 through 32 are allowable as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

With respect to claims 30 through 32, Applicant submits that there is a lack of motivation to combine Rostoker with Wood and Kaiser in the manner proposed by the Examiner. Again, Wood does not teach or suggest that the substrate wafer (20W) has any electrical function, but, rather, is a structural component. As such, Wood does not advocate the preparation of a multi-die assembly and, therefore, there is a lack of motivation to "attach at least two active face-down base die" to the device of Wood, or to otherwise bridge the die with at least one stack die or secure at least another stack die thereto.

Additionally, Kaiser teaches a very specific arrangement due to the need for compactness of the resulting structure for the specific application thereof. Using at least two face-down base die, bridging the at least two base die with a stack die, or securing at least another stack die to the assembly would increase the size of Kaiser's structure which is contrary to Kaiser's stated goals and objectives.

Applicant, therefore, respectfully requests reconsideration and allowance of claims 30 through 32.

Objections to Claims 26 and 28/Allowable Subject Matter

Claims 26 and 28 stand objected to as being dependent upon rejected base claims, but are indicated to contain allowable subject matter and would be allowable if placed in appropriate independent form. As detailed hereinabove, Applicant submits that claim 19, from which claims 26 and 28 depend, is in condition for allowance. Applicant, therefore, submits that claims 26 and 28 are also in condition for allowance and respectfully request reconsideration thereof.

ENTRY OF AMENDMENTS

The amendments to claim 19 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Further, the amendments do not raise new issues or require a further search.

CONCLUSION

Claims 19, 21 through 23, and 25 through 34 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,



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